Description

Air induction module for a combustion engine having pulse charging

The present invention relates to an air induction module for a combustion engine having pulse charging.

During pulse charging (dynamic charging) pulse charging valves (timed valves) are used in the induction pipe of the combustion engine to increase the mass of air in the combustion chamber by the pulse charging valve opening and closing once or repeatedly during the opening phase of the inlet valve, reference might be made, for example, to 'Combustion Engine Manual', second edition, page 386, section 10.5.3. Pulse charging can be used both for petrol and diesel combustion engines.

The present application relates, in particular, to the integration of such pulse charging valves in the induction pipe of the combustion engine. In this connection, the following observations, amongst others, can be considered:

The pulse charging valves and their actuators should be semi-rigidly attached to the housing of the combustion engine. The electrical power loss in the actuators should be removed by the air flowing through the air induction module. Moreover, the electronic control device required to control the actuators, including the electrical contact of the actuators, should be integrated in the air induction module, whereby

attention should be paid to the thermal and mechanical connection of the electronic control device to the combustion engine and the removal of the electrical power loss of the electronics in the form of heat should be ensured at all operating points.

The object achieved by the present invention is therefore to provide an air induction module for a combustion engine with pulse charging, in which the pulse charging valves and their actuators are integrated as optimally as possible in the induction pipe, with regard to space requirements, constructional cost, vibrational load, heat removal and further operational characteristics.

This object is achieved by the air induction module defined in claim 1.

In the air induction module configured according to the invention, the induction pipe is comprised of two separate induction pipe bodies which are connected to one another by a flanged joint, such that the induction pipe sections provided therein together form the individual induction pipes of the induction pipe. The first induction pipe body contains an air collector and individual induction pipe sections leading off therefrom. The second induction pipe body with its induction pipe sections can be attached to the cylinder head of the combustion engine.

Due to this two-part construction of the induction pipe, one respective pulse charging valve with an associated actuator

can be arranged in the induction pipe sections of the second induction pipe body. In principle, the pulse charging valves can be of any construction. Preferably, however, they are comprised of poppet valves, of which the actuators are formed by solenoids.

The invention therefore permits a constructively simple and space-saving integration of the pulse charging valves in the induction pipe. The invention also represents an optimal solution with regard to the vibrational load. It is particularly advantageous that, due to the integration of the pulse charging valves and their actuators in the induction pipe sections of the second induction pipe body, the actuators are surrounded by the air flowing through the induction pipe, ensuring cooling of the actuators and thus the removal of the electrical power loss of the actuators.

The air induction module configured according to the invention is therefore easily suitable for mass production.

Both the first and the second induction pipe body can be manufactured from a metal material, such as for example an aluminum alloy or even a plastics material, such as for example polyamide.

The electronic control device for controlling the actuators of the pulse charging valves can be attached to the air filter housing of the combustion engine such that it is cooled by the air flowing through the air induction module. Instead of this, however, the electronic control device can also be attached to

the first or second induction pipe body such that it is cooled by the air flowing through the first and/or second induction pipe body.

In a further embodiment of the invention it is provided that an electronic connector (leadframe) for the line connection between the actuators of the pulse charging valves and the electronic control device is integrated in the second induction pipe body. If the second induction pipe body consists of plastics material, the plastics material of the second induction pipe body is preferably cast around the electronic connector and it can then be electrically connected by a plug connection to the actuators of the pulse charging valves. By means of this integrated electronic contact, a further reduction of the manufacturing costs and an increase in operational reliability result. Moreover, depending on the construction, contacting errors (transposing the cylinders) are avoided.

Further advantageous embodiments of the invention are revealed from the sub-claims.

An exemplary embodiment of the invention is described in more detail with reference to the drawings, in which:

Fig. 1 is a perspective exploded view of an air induction module;

Fig. 2 is a perspective view corresponding to Fig. 1 of the air induction module in the assembled state;

Fig. 3 is a partial sectional perspective view of the air induction module from another viewpoint.

The air induction module shown in Figures 1 to 3 serves as an air induction system of a combustion engine (not shown) which can be configured as a petrol or diesel combustion engine and, in the embodiment shown, is a four cylinder combustion engine.

As can be seen, in particular, in the exploded view of Fig. 1, the air induction module comprises an induction pipe which is divided up into a first induction pipe body 1 and a second induction pipe body 2. Furthermore, the air induction module comprises pulse charging valves 3 with associated actuators, which are inserted into the second induction pipe body 2, as will be described in more detail. The two induction pipe bodies 1 and 2 can be connected to one another by a flanged joint 4 with an intermediate plate 5, as will also be described in more detail.

Furthermore, the air induction module has a throttle valve 6 and an air filter housing 7 which can be connected to the throttle valve 6 via a clean air duct 14 which is shown only in part in Fig. 3.

The first induction pipe body 1 comprises an air collector 8 which, on the side which can be seen in Figures 1 and 2, has an air inlet with the throttle valve 6 arranged therein. Depending on the number of cylinders, four curved induction

pipe sections 9 terminating in a common flange portion are attached to the air collector 8.

The second induction pipe body 2 is also provided with four induction pipe sections 10 which, in the assembled state of the air induction module (see Figures 2 and 3), continue the induction pipe sections 9 of the first induction pipe body 1. The induction pipe sections 9 and 10 thus form the individual induction pipes of the induction pipe.

The pulse charging valves 3 visible in Figures 1 and 3 are, in the embodiment shown, poppet valves with actuators in the form of solenoids with two respective solenoid coils. Each of the poppet valves with the associated actuator forms a component part which, as such, can be inserted into one respective induction pipe section 10 of the second induction pipe body 2. The pulse charging valves 3 with their actuators are held in the induction pipe sections 10 of the second induction pipe body 2 by the intermediate plate 5, which is attached to the second induction pipe body 2 by screw connections 11.

In this manner, the pulse charging valves 3 with their actuators can be easily inserted into the induction pipe. This arrangement is, moreover, particularly advantageous with regard to space requirements and vibrational load. Moreover, the arrangement is such that the air flowing through the induction pipe is conveyed around the actuators, whereby the actuators are cooled and thus their electrical power loss is effectively removed.

The first induction pipe body 1 is attached to the intermediate plate 5 by screw connections 12. The intermediate plate 5 is provided with through holes which ensure a smooth flow transfer between the induction pipe sections 9 and the induction pipe sections 10 of the two induction pipe bodies 1, 2.

The induction pipe bodies 1 and 2 can consist of a metal material, such as for example an aluminum alloy. Advantageously, however, they consist of plastics material, such as for example polyamide, with the resulting advantages.

An electronic control device 13 is provided to control the actuators of the induction pipe valves 3 which is attached to the air filter housing 7 in the embodiment shown. To this end, the air filter housing has an opening over which the electronic control device is located. In this manner, air flowing through the air filter housing 7 is conveyed past the rear face of the electronic control device 13, whereby the electronic control device 13 is cooled and its electrical power loss is removed.

Instead of the arrangement shown in Figures 1 to 3, the electronic control device 13 could be attached to the first induction pipe body 1 or to the second induction pipe body 2, according to the particular installation conditions, so that it is cooled by the air flowing past.

An electrical connector - not shown - (leadframe) which consists of a copper part with electrical conductors and

molded plug pins is provided for electrically contacting the actuators of the pulse charging valves. This connector represents the electrical line connection between the actuators of the pulse charging valves 3 and the electronic control device 13.

The electrical connector is expediently integrated in the second induction pipe body 10. If the second induction pipe body 2 is configured as an injection-molded part made of plastics material, the electrical connector is inserted into the plastics injection molding die for the second induction pipe body 2 and during the injection molding process the hot plastics material is injected around said connector, so that only the plug pins protrude from the plastics material. The arrangement is therefore such that when inserting the pulse charging valves 3 with their actuators in the induction pipe sections 10 of the second induction pipe body 2, an electrical contact between the plug pins of the connector and plug sockets provided on the actuators is automatically produced.

In this manner, the electrical contact of the actuators of the pulse charging valves 3 is optimally integrated in the induction pipe which simplifies the manufacture and assembly, increases the operational reliability and in particular avoids contacting errors (i.e. transposing the cylinders).

Claims

1. Air induction module for a combustion engine having pulse charging,

- with an induction pipe with individual induction pipes depending on the number of cylinders of the combustion engine, which induction pipe comprises:

- a first induction pipe body (1) with an air collector (8) and individual induction pipe sections (9) and

- a second induction pipe body (2) with individual induction pipe sections (10) which can be attached to the cylinder head of the combustion engine,

- whereby the first and second induction pipe bodies (1, 2) are connected to one another by a flanged joint (4), such that their induction pipe sections (9, 10) together form the individual induction pipes of the induction pipe, and

- one respective pulse charging valve (3) is arranged with an associated actuator in the induction pipe sections (10) of the second induction pipe body (2).

2. Air induction module according to claim 1, characterized in that the pulse charging valves (3) are configured as poppet valves.

3. Air induction module according to claim 2, characterized in that the actuators of the induction pipe valves (3) consist of solenoids.

4. Air induction module according to any one of the preceding claims, characterized in that each pulse charging valve (3) with the associated actuator forms a component part which during assembly of the air induction module can be respectively inserted in the correspondingly formed associated induction pipe section (10) of the second induction pipe body (2).

5. Air induction module according to any one of the preceding claims, characterized in that the flanged joint (4) between the two induction pipe bodies (1, 2) comprises an intermediate plate (5) with through holes corresponding to the individual induction pipes which can be attached to the second induction pipe body (2) by screw connections (11) such that the intermediate plate (5) holds the pulse charging valves (3) with their actuators in the induction pipe sections (10) of the second induction pipe body (2).

6. Air induction module according to claim 5, characterized in that the intermediate plate (5) can be attached to the first induction pipe body (1) by screw connections (12).

7. Air induction module according to any one of the preceding claims, characterized in that the second

induction pipe body (2) consists of a metal material or plastics.

8. Air induction module according to any one of the preceding claims, characterized in that the first induction pipe body (1) consists of a metal material or plastics.

9. Air induction module according to any one of the preceding claims with an electronic control device (13) for controlling the actuators of the pulse charging valves (3) characterized in that the electronic control device (13) can be attached to an air filter housing (7) of the combustion engine or to the first induction pipe body (1) or second induction pipe body (2) such that it is cooled by the fresh air flowing through the air induction module.

10. Air induction module according to claim 9 with an electronic connector for the line connection between the actuators of the pulse charging valves (3) and the electronic control device (13), characterized in that the electronic connector is integrated in the second induction pipe body (2).

11. Air induction module according to claim 10, in which the second induction pipe body (2) consists of plastics material, characterized in that the plastics material of the second induction pipe body is cast around the electronic connector, which can be electrically connected

by a plug connection to the actuators of the pulse charging valves (3).

12. Air induction module according to any one of the preceding claims with an air filter housing (7), characterized in that the air filter housing (7) can be attached to the first induction pipe body (1) or to the second induction pipe body (2).

13. Air induction module according to any one of the preceding claims, characterized in that a throttle valve (6) can be attached to the collector (8) of the first induction pipe body (1).